p. 303 the fat resynthesised in the intestinal wall is stated to be different from the original fat hydrolysed in the cavity of the intestine. This is not the case.

(2) Dr. von Fürth's book is well known to many of us in the original as a valuable presentation of the facts of the subject at the time it was written. The use of the word "problems" in the title may cause a little disappointment to those who look for assistance in attacking difficult questions; something resembling Leathes's "Problems of Animal Metabolism" may have been expected.

It seems doubtful to the reviewer whether the translation of a general text-book is worth the trouble and expense unless the translator is possessed of the knowledge and capacity to bring it up to date. A new edition of the original work is almost certain to appear before the translation is exhausted, so that the latter prolongs the life of an antiquated edition, which is undesirable. The contents of the present book date from some time prior to 1913. On the whole, it is questionable whether any real necessity existed for its translation, since there are other books in the English language which serve the purpose. W. M. BAYLISS.

SOME MATHEMATICAL TEXT-BOOKS.

(1) *Dynamics.* By R. C. Fawdry. Part i. Pp. viii + 177 + ix. (London: G. Bell and Sons, Ltd., 1916.) Price 3*s.* net.

(2) *Differential and Integral Calculus.* By Dr. Clyde E. Love. Pp. xviii + 343. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 9*s.* net.

(3) *Engineering Applications of Higher Mathematics.* By V. Karapetoff. Part ii. Pp. iv + 103. Part iii. Pp. v + 113. Part iv. Pp. v + 81. Part v. Pp. vii + 64. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 3*s.* net each.

(1) THIS is a text-book of elementary dynamics, leading up to circular motion. One naturally turns first to see how the foundations are treated, and here we must confess to some disappointment. Various experiments with a "trolley-apparatus" are quoted, and are used as a basis for the fundamental inductions. As a matter of fact, dynamics did not begin in this way, but with the testing of hypotheses. Such experiments are useful and instructive enough, as verifications, at a somewhat later stage; but they are too rough and too liable to error to serve as the basis of dynamical faith. They are also necessarily indirect, and various assumptions have to be made before they can be regarded as bearing specifically on the points they are meant to illustrate. The article on "mass" also is vaguely worded, and scarcely adequate to its purpose. Nevertheless, the book has points which may make it useful to a teacher who takes the theory largely into his own hands. The examples are well chosen and of the right standard of difficulty, and there are good exemplifications of such things as relative motion and centrifugal force.

(2) This book gives an account of the calculus from the first elements to the theory of ordinary differential equations. It includes also chapters on the applications to geometry and mechanics. Since the whole takes up only some 300 pages, it will be seen that the treatment is necessarily concise. It can, however, be recommended as a good introduction to the subject, and it is doubtless intended that it should be supplemented by plentiful oral comment. The examples are of a simple character, and bear directly on the text.

The book, naturally and properly, having regard to its scale, does not attempt to deal with the more abstruse logical points which present themselves in the beginning of the subject. The author is, however, to be congratulated on the practice he has generally adopted of stating explicitly when he makes an assumption which it is not convenient to stop and prove. There are two respects in which he has, we think, been unduly conservative. The treatment of the exponential and logarithmic functions and of their derivatives scarcely brings out the special importance of the former function, the logarithm being practically used as the primary conception. The proof of Taylor's theorem, again, is of the usual indirect and artificial character. One cannot but feel sympathy for the type of student whom Todhunter tried (vainly, we hope) to placate with the somewhat cruel remark that "he must not, while engaged in the elements of a subject, expect to be able, as it were, to *rediscover the theorems for himself.*" It is no doubt difficult to present these matters in a way at once natural and fairly rigorous, but the attempt should be made.

(3) We have here four parts of a work on the application of higher mathematics to engineering. In the words of the author:—"The book may be called a summary of the most common engineering applications of higher mathematics, or a mathematical cross-index to engineering text-books. It fulfils its purpose if it saves the teacher the trouble of consulting many engineering books for the purpose of selecting a few mathematical problems for his students. The author also hopes that the book may stimulate interest in higher mathematics among his fellow-engineers." It should be said that the term "higher" is used in rather a restricted sense, and that the reader will find many quite elementary things explained to him. For example, it is formally proved that the minimum value of $x+y$ subject to the condition $xy=\text{const.}$ occurs when $x=y$; this with the help of the calculus!

The four slender volumes before us deal with hydraulics, thermodynamics, elasticity, and electricity respectively. The treatment is, on the whole, sound, though the diction is often rather loose. For instance, it is not easy to justify the offhand statement that the internal stresses in a cross-section of a beam are proportional to the bending moment, "since the action of these forces is to bend the beam." The mathematical work is not distinguished by neatness, and one finds awkward and cumbrous proofs where often quite

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simple methods are available. The author appears afraid of making undue demands on the knowledge of his readers, and when a real difficulty occurs contents himself with a reference to a text-book.

The treatment of the strength of thick cylinders and spheres may be cited as characteristic. The final formula is evolved as the result of five successive approximations, and the whole investigation takes up twenty-four pages. Would it not be really simpler, as well as much shorter, to give the well-known correct investigation at once? It is a little more difficult, but there are no precarious assumptions, and by the time he had mastered it the engineering student would really know something about stresses and strains.

These criticisms must not be taken to reflect on the competence of the author, whose aims, as recorded in his prefaces, are excellent. But he does not seem to have a high opinion of the attainments of the class of students whom he addresses.

OUR BOOKSHELF.

The Problem of Pain in Nature. By C. F. Newall. Pp. 131+7 illustrations. (Paisley: Alexander Gardner, 1917.) Price 3*s*. 6*d*. net.

THIS little book may be useful to those who are troubled in spirit by what they believe to be a fact: that animals in wild life suffer much pain. Mr. Newall explains in a simple way why he regards this shadow on Nature as, on the whole, of man's imagining. For the humblest animals "no brain, no pain" seems good sense; and animals of the little-brain type, such as insects, the behaviour of which is predominantly reflex and instinctive, often go on as if they were callous to serious injuries. A dragon-fly which has lost its hindquarters is not thereby hindered from eating a good many flies, and finishing up with its own lost parts.

We cannot, of course, be sure how much sensation of pain there is among invertebrates, but Mr. Newall's quiet consideration of the facts suggests that there is but little. When we pass to vertebrate animals the argument from analogy becomes more trustworthy, and Mr. Newall refers to the experiences of men who have been in the grip of wild beasts without feeling much, if any, pain or fear.

In most cases in wild life the *coup de grâce* is instantaneous. It may be argued, indeed, that Nature is rich in efficiencies that lessen the chance of pain. Selous was strongly of opinion that Wallace erred in his low estimate of the evolution of pain-sensations among animals, but he himself attached too much importance to cries and the like. Many a one might conclude from a baby's cries that the mother was slowly torturing it. We think that there is good sense in Mr. Newall's conclusion that men have greatly exaggerated the prevalence of pain in Nature, but we are afraid of some of the arguments, for they seem also to banish pleasure. In a short book like this the reader should be spared "amydallin," "etherial," "Eperidæ," "Barlett," and "Sir James Lister," which we happened to notice.

The Elements of Engineering Drawing. By E. Rowarth. Pp. xii+131. (London: Methuen and Co., Ltd.) Price 2*s*. 6*d*. net.

THE main purpose of this book is to give examples of, and instruction in, the art of draughtsmanship, for the benefit of young students just entering on an elementary course of engineering. It is intended as a corrective to the unworkmanlike finish and execution which are apt to accompany a too exclusive use of models and machine parts, with their dimensioned sketches, in the teaching of machine drawing.

The general treatment of the subject is somewhat meagre and crude, but the plates are executed in a style that would be approved by the professional draughtsman; the instructions annexed to each plate are full and precise, being helped by pictorial views; and the book seems to be specially suitable for dealing with large classes of junior students where it is not practicable to give much individual attention.

The text is divided into four sections relating to the manipulation of instruments, the method of projection, and the forms and proportions of the commoner machine fastenings, with examples of their use.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

British Optical Science.

As a manufacturer, may I be allowed to reply to Sir Joseph Larmor's letter in NATURE of March 1 on the subject of British optical science, in which he makes certain statements that must create an entirely wrong and unfortunate impression of the circumstances?

What is the reason for the comparative smallness of the British optical industry? If one considers the pre-war output of the important German firms, it will be seen that they are based upon their military departments of which the public of other countries knows very little. It only knows the German firms by their civilian productions. The German War Office in peace-time issued large orders for optical instruments and placed them with German firms, on the principle that the optical industry would be a vital one in time of war. Having such large orders to deal with, and having the certainty of continuity of work, the German firms were enabled to develop special machinery and appliances and to develop their general organisation.

As suppliers of the largest Continental Army, the German firms naturally obtained the bulk of the orders of other Armies, with a consequent increase of their facilities and experience. In such circumstances it was comparatively easy to establish and maintain a civilian world trade.

Consider now the British conditions. The pre-war British orders were of negligible importance compared

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